EARTHQUAKE INSIGHT FIELD TRIP

Regional Seismic Hazard Information Transfer
To Executive Policymakers & Private Sector Leaders

National Earthquake Hazards Reduction Program
NEHRP – FY 2005

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Earthquake Insight Field Trip
Final Report

EXECUTIVE SUMMARY

The *Earthquake Insight Field Trip* was held May 31 – June 3, 2005. Participants included 30 key individuals from all over the country, mostly from the insurance industry, who were invited to see firsthand and to learn about earthquake hazards and earthquake risk in the central US, especially that due to the New Madrid fault system.

This event targeted those in a position to *make changes within society at large* to minimize earthquake risk in the central US. Private-sector leaders, especially those in finance, equity, logistics and distribution, investments, insurance, business operations, manufacturing, energy, infrastructure, and other key industries, were specifically courted. State and federal policy-makers, especially elected officials, were also targeted.

The three-day, 800-mile-long event included field stops at university research centers, key structures in the process of being retrofit, vulnerable industries and operations, visible geologic evidence of past earthquakes in the region, and related sites and sights between St. Louis, Mo., and Memphis, Tenn.

Leveraged value was a key element of the field trip. Several hundred customized announcements describing the field trip were published in various electronic and hardcopy newsletters and trade magazines, which resulted in visibility of the issue before key audiences. Dozens of interviews with reporters from local and regional print and broadcast media were completed along the route, which resulted in numerous news features and reports. Participants were challenged to take what they learned and apply it to their operations and organization. Participants unanimously agreed that the event was valuable to them, individually, as well as their organizations and their industries.

Results were exceptionally encouraging. A Benefit-Cost Ratio (BCR) of more than 50,000 was achieved. Field trip participants estimated the practical value of the field trip to be more than $2,121,000,000.

Recommendations include using this *Earthquake Insight Field Trip* as a template for similar future, outreach events that target specific and empowered audiences.

1 Introduction

This report documents the *Earthquake Insight Field Trip* that was part of the US Geological Survey's 2005 National Earthquake Hazard Reduction Program. This award, No. 05HQGR0014, was part of the USGS External Research Program (ERP) for the central and eastern United States. It was awarded to Grantee, Phyllis Steckel, RG, an Independent, consulting geologist, from Washington, Mo. (psteckel@charter.net)

There were three main elements of this project.

First, this grant funded development and execution of a three-day, field trip through the central United States, from St. Louis, Mo., to Memphis, Tenn. The field trip topic was an intense, immersion-type, learning experience that addressed earthquake risk in the central US. Participants included 30 high-level decision-makers in the public and private sector, state and federal elected officials, and association executives from key professional and industry organizations.

Second, at least 25 presenters addressed the field trip participants at various stops along the way and at least a dozen presenters stayed with the group during the entire three-day field trip. These presenters are scientists and engineers who are actively working toward understanding and minimizing earthquake risk in the central US. Their role was to interact with, not just lecture to, the field trip participants. This interaction created personal, points-of-contact between the geoscience and engineering communities and those in the public and private sector who are in a position to make changes to minimize earthquake risk in the central US. This interaction is beneficial to the presenters as well as the participants.

Finally, the benefit or value of the field trip to the participants was to be leveraged by applying some basic marketing applications to the effort. This included measuring the value of mitigation actions and "word of mouth" information transfer taken by field trip participants after the field trip. More than 10 local and regional newspaper articles; more than a dozen television and radio interviews; at least 50 trade magazine and newsletter articles; and significant "professional chatter" among participants and their co-workers, peers, clients, and suppliers resulted from this leverage.

2 Purpose of the *Earthquake Insight Field Trip*: The Importance

The ultimate purpose of the *Earthquake Insight Field Trip* was to reduce earthquake risk in the central US. *Earthquake hazards*, such as ground shaking, liquefaction, lateral spreading, and landslides, become *earthquake risks*, when life and property are exposed to their negative effects.

This field trip effort was to create a cost-effective model for future, highly effective, and highly cost-effective, outreach efforts that target key audiences.

3 Objective of the *Earthquake Insight Field Trip:* The Mission

The objective of the *Earthquake Insight Field Trip* was to proactively reach out to a key audience of decision-makers. These individuals have both the authority and responsibility to make earthquake risk-reduction changes for their organizations, industries, and constituencies.

By tapping this key audience, the extremely modest budget of this field trip (about $42,500) was leveraged into a value to society that is several orders of magnitude larger.

This leveraged value for outreach efforts may extend to future efforts, such as additional field trips, professional exchanges between the geoscience and engineering community and the private sector and policy-making communities, and other efforts. These future extensions will add additional, leveraged value to the field trip.

4 Scope of Work: The Plan

The scope of this work included five tasks, described below.

4.1 *Task 1 – Field Trip Development*

This task included several elements.

The main event of this project was an intense, three-and-a-half day, five-state, 800-mile-long field trip experience for 30 well-positioned, executive decision-makers from both private industry and elected policy-makers. Presentations were made at more than 35 stops and en route vantage points along a circuitous route from St. Louis, Mo., to Memphis, Tenn. Stops included university labs; sites of historic earthquake damage; specific structures engineered or retrofit to resist earthquake shaking; field sites of geologic or earthquake significance; and specific industries especially exposed to earthquake risk, such as urban redevelopment in unreinforced masonry (URM) structures (St. Louis and Memphis), steel-making (Mississippi County, Ark.), and distribution and logistics (Memphis).

This task also included coordinating the logistics for the field trip. This included arranging for a 56-passenger motor coach, three hotel-nights for 40+ people, 10 on-the-road meals for 40 to 50 people, and an escort vehicle to accompany the motor coach during the event. Two field-trip assistants, Rick Schwentker and Katie Steckel, were hired to help with the logistical details during the field trip (guidebooks, lunches, and refreshments) and to manage an "escape mechanism" if someone had to leave the trip due to illness, injury, or family emergency.

Other *Task 1* efforts included enlisting and coordinating the support of more than 25 research and practicing geoscientists and engineers; and local, state, and federal government officials. It also included developing a 50-page guidebook, which was given to each field trip participant and to many presenters.

Perhaps most importantly, it also included developing and supporting the "story" of central US earthquake hazards and earthquake risks in a way that would be understandable and meaningful to the field trip participants.

While the details of this task alone could have choked a committee, having just one decisive person, the Grantee, "in charge" allowed executive decisions to be made on the fly. Time spent in logistics meetings was zero.

4.2 *Task 2 – Inviting the Participants*

This task included significant brainstorming and research of trade and professional societies (Appendix A), key individuals, and state and federal elected officials. Essentially all of this research was done on-line.

Those who were especially targeted as participants in the *Earthquake Insight Field Trip* included those who are involved in equity (largely, "ownership" that includes holders of stocks and bonds, corporate capital improvements, real and improved property, and similar portfolio-caliber investments), valuation, finance, operations, and insurance. Generally, for the purpose of this field trip, "equity" did not address owner-occupied residential properties, with the exception of mortgage banks that may hold a high percentage of those properties within their corporate portfolio.

This task also included identifying individuals who are responsible for key operations in organizations having an especially high earthquake risk exposure in the central US. Those individuals (about 300 people) were sent customized letter invitations (Appendix B) that included personal signatures and hand-written notes expressing the importance of this event.

The letters were accompanied by a less formal, one-sheet FAQs [Frequently Asked Questions] (Appendix C) that offered a detailed explanation of the mission, route, stops, expectations, and requirements of the trip. These invitations also included a letter of endorsement (Appendix D) signed by Dr. Eugene Schweig and Dr. Joan Gomberg, USGS contract managers. The latter was to provide credibility to the invitation as well as additional points of contact for questions by the invitees.

Press releases and newsletter announcements (Appendix E) were written and customized for well over 500 professional, trade, and industry organizations. The FAQ-sheet was also included in press releases, with the intention that at least some editors would pass them on to their members. Many of these were addressed to local chapters of national organizations. Regions that were especially targeted included St. Louis, Memphis, Kansas City, and Chicago, due to their geographic proximity and risk exposure.

Other regions were especially targeted for their concentration of key audience members. These included Iowa, Connecticut, Delaware, and Rhode Island, because of their concentration of insurance companies; the New York City to Boston corridor, because of its concentration of equity industry; and Washington DC-area groups that include high numbers government-industry liaisons.

Other areas that are home to industries especially dependent on the Memphis logistics and distribution industry were also targeted. This included Detroit (auto after-

market products); Atlanta (hardwoods and paper products); Silicon Valley, Calif. (electronics parts and consumer goods); and Boston (surgical instruments).

For example, trade and professional groups that served those in the equity area received press releases that included terms and addressed perspectives such as "valuation," "portfolio balance," and "appreciation." Those groups serving the insurance industry received information that included perspectives and terms such as "risk management," "exposure," and "actuarial function." Those serving production, manufacturing, and business operations received information that included terms and concepts such as "business continuity," "value added," and "just-in-time delivery."

These hot-button industry terms indicated to the editors (and, eventually their readers) that the field trip was not just for scientists and engineers.

Customizing these press releases and announcements took some time. This was also a critical step in communicating with these audiences that, simply, cannot be overlooked or short-cut.

These customized press releases and newsletter announcements were not only sent to the trade and professional groups' editors of their national publications, but also to regional and chapter points-of-contact, as well. At the regional and chapter level, many of these individuals were volunteers. The receipt of many of these announcements was at least acknowledged. Some were received enthusiastically, with promises to forward to local members. However, one local newsletter editor offered to forward the announcement to his chapter's members for $50.00 – which was politely declined.

By enlisting the help of these local chapters and regional districts of targeted national organizations, the announcement of the field trip was offered as a credible event that, in the very least, may be of interest to the organizations' members.

Appendix F includes the list of participants.

4.3 *Task 3 – Field Trip Accounting*

Field trip participants were offered a significant subsidy, funded through this grant, to participate in the *Earthquake Insight Field Trip*. Each participant was required to contribute $400.00 toward the actual cost of the trip, to help cover transportation, hotels, meals, and other development expenses. Actual costs were closer to $1600.00 per person.

This $400.00 per participant was required for several reasons. First, this cost was low enough for everyone who was a part of the targeted audience to participate: the cost actually was considered to be *very low* by all participants. However, it was high enough to "get their attention" – a check had to be cut, or a purchase order had to be arranged, or

an approval had to be secured. For most participants, the $400.00 cost was much less of an issue than the four days needed to join the group.

The project budget plan allowed one or two "scholarships" to be offered to key people from especially important non-profit groups whose participation could leverage significant value to the field trip outreach effort. National Public Radio [NPR] (who *almost* sent a participant) is an example of an organization eligible for such a scholarship. However, due to schedule constraints, no one from any scholarship-eligible organization was able to participate on the field trip.

Field trip presenters were offered two options, depending on the accounting requirements of their respective organizations, which included numerous state and federal agencies, non-profit groups, and several universities.

Presenters could pay either the $400.00 per person (hotels included) or $191.00 per person (hotels not included). These options were necessary to meet the accounting and travel requirements of the various presenters' organizations. These costs-per-person were also considerably less than actual costs, and were offered to the presenters as a professional courtesy and to minimize accounting requirements and burden for the project. A list of field trip presenters is included in Appendix G.

To handle and process the payments sent in by participants and presenters, a non-interest-bearing bank account was opened, titled to "*Earthquake Insight Field Trip,*" at the Bank of Franklin County, in Washington, Mo. All revenue generated from these payments by the participants and presenters was directly applied to project labor and expenses. This project-only bank account was closed as of September 30, 2005.

This task, the administration of the accounting aspect of the *Earthquake Insight Field Trip*, was somewhat demanding, due to the different and ever-changing requirements of the presenters' organizations. Detailed documentation of all revenue and expenses generated by the field trip is available in project files.

Significant travel expenses (more than $10,000) were paid by the project during the actual field trip, such as hotels, meals, and supplies. All these were paid via the Grantor's personal MasterCard, which is a part of the *Amtrak Guest Rewards Program.* Free Amtrak travel was earned by the project through these purchases, which was redeemed for travel to the Geological Society of America's 2005 Annual Meeting in Salt Lake City, Utah. A paper describing the *Earthquake Insight Field Trip* was given in October 2005 at that meeting.

4.4 *Task 4 – Leading the Earthquake Insight Field Trip*

The *Earthquake Insight Field Trip* began on Tuesday evening, May 31, 2005, in St. Louis, Mo. As participants and presenters arrived, the field trip leader and the two staff helpers welcomed them at the "Welcome Desk" set up at the hotel. At the banquet

dinner that evening, at an Italian restaurant next door to the hotel, all participants, presenters, and staff introduced themselves, giving key background details. Several "setting the stage" presentations were given after the meal. Most retired early to be ready for an early start the next day.

From Wednesday morning, June 1, through early afternoon Friday, June 3, the field trip progressed as planned. The guidebook, which includes a detailed road log, is included in Appendix H. All in all, it was quite noisy on the bus during drive time: participants and presenters were talking about what they were seeing, why it was important, and how it affects the big-picture of earthquake risk in the central US. Questions were answered and discussed. Business cards were exchanged. Camaraderie blossomed.

The guidebook also included a list of regional medical facilities (Appendix I). This list included telephone numbers and street addresses to be used in the event any participant or presenter needed to leave the group to seek medical attention. The driver and assistant in the escort vehicle also had been familiarized with the general route to the closest medical facility along the field trip route.

Numerous local newspapers and radio and television stations were informed of the field trip coming to their areas. This was done by a series of press releases (Appendix J) that were customized for each outlet and geographic area and sent just a few days before the field trip came to their area. These press releases included the location of the stops the group would make in their area, what the participants would be seeing at each stop, why it is important, and the approximate time the motor coach would arrive. "Photo ops" were also suggested and several story ideas for additional investigative reports were offered.

Along the way, the field trip met up with numerous members of the local and regional media. Reporters from newspapers and radio and television stations met with key participants and presenters in St. Louis, Ste. Genevieve, Cape Girardeau, and New Madrid (all in Missouri); Hickman, Ky.; Reelfoot Lake, Tenn.; Blytheville, Ark.; and Memphis, Tenn. At least 15 news stories resulted in local print and broadcast media.

This outreach to local media is another way to leverage the value of this field trip: all the local and regional newspaper articles and radio and television reports add to the overall awareness of central US earthquake risk within the general public.

The field trip officially adjourned at about 2:00 pm on Friday, June 3, in Memphis, Tenn. Just before the final dismissal, the entire group enjoyed a seven-minute PowerPoint presentation of nearly 100 photos taken during the trip, including several taken that morning. The junior staff assistant, Katie Steckel, documented the event and created the presentation in the hotel in the evenings and while riding in the escort vehicle. It was an enjoyable and proud-mama-moment testimony to the flexibility and promise of youth!

Participants and presenters could then leave from Memphis or ride the motor coach back to St. Louis. About half the group left from Memphis. Those who chose to ride the coach back to St. Louis enjoyed a final meal together at Lambert's Café (a landmark, down-home restaurant in Sikeston, Mo.) before a final adieu back at the St. Louis hotel.

All in all, the trip itself was logistically uneventful. There were no illnesses nor injuries and no family emergencies. No one was left behind. There was no trouble with the route or motor coach, the hotel accommodations and the meals went as planned, and the weather was beautiful.

Dumb luck was a very welcome member of the party.

4.5 *Task 5 – Critiques and Leveraged Value to Society*

One mission of the *Earthquake Insight Field Trip* was to motivate participants to take action to reduce earthquake risk in the central US. At the end of the field trip, participants were asked to complete a critique of the event. Results were extremely encouraging: on a one-to-five scale, five being the highest or most positive, all program elements were rated greater than 4.0 and all but three were rated 4.5 or higher.

Appendix K includes the reduced data from the critiques, and Appendix L includes specific comments from the critique sheets.

Appendix M includes a summary of ***leveraged value to society at large*** of the *Earthquake Insight Field Trip*. There was a wide range of values cited by participants in response to this query. Some may not have understood that the intent of the question was not "what their company would have paid to participate" (i.e., instead of the subsidized $400. cost-per-participant, up to what price would have been a reasonable cost assigned to the event for one person to participate). Rather, the intent of the question was to estimate the leveraged value to society at large the results of the risk-reduction actions that will be taken as a result of participation in the field trip. For example, if the practice or protocol of any aspect of the organization is changed to reduce risk to that organization from earthquake risk in the central US, what is the value of that change?

One participant who did understand the question was from a $50,000,000,000-a-year pharmaceutical company. Based on personal discussions with this individual, it is clear that he *did* understand the question. His estimate of a $2,000,000,000-value of the trip is reasonable because that firm manages much of its high-value inventory in extremely high-risk tilt-up warehouse structures in Memphis. By recognizing the risk to the firm's overall operations as a result of the *Earthquake Insight Field Trip*, he is in a position to take action now to minimize the cost of actual inventory loss, business interruption, and loss of market share when a large, central US earthquake occurs.

Several other individuals also clearly understood the question and estimated the value of the *Earthquake Insight Field Trip* to be well in the five- to eight-figure range. Judging their company, role in the industry, and personal awareness of the central US earthquake-risk issue, these estimated numbers are quite reasonable.

The total estimated ***leveraged value to society at large*** is $2,121,582,571.

Several weeks after the field trip, participants were contacted via email to document the progress they had made in reducing earthquake risk within their organizations. For unknown reasons, the response to this query was not very good. Perhaps it was due to summer vacations, guilty consciences (due to lack of progress?), or due to not having enough time to respond. In any event, comments from several participants are included here to show that at least some progress, and in some cases some significant progress, had been made.

Hi Phyllis,

Thanks again for allowing me to attend your earthquake field trip. I was impressed (as were others) with the breadth of information covered and the level of professionalism with which it was delivered.

As I am employed with a modeler, I wasn't sure how much the action items applied to me. The following are some general notes:

1. *I was encouraged to be more of an in-house expert regarding our New Madrid EQ model. There are tentative plans to update this model in the next year or two. My being better informed will allow me to better support existing customers and attract new ones (value = $25,000)*
2. *I read an additional book on NM entitled "The Big One" (value = zero)*
3. *I was encouraged to better understand the "vulnerability" of different building types, including industrial facilities (a separate RMS model from commercial residential properties). Being better able to market this Industrial model is a benefit to my company. (value = $15,000)*
4. *I researched and found the Mid America EQ Center, affiliated with the University of Illinois. This organization is located nearby and may present an opportunity for my colleagues (and customers) to better understand earthquake risk.*

Best of luck,

Regards,

D.

* * *

Hello Phyllis,

I have one action item that has been approved but not yet begun. Since [our company] writes personal lines insurance, our action relates to homeowners and is as follows:

Send earthquake loss mitigation brochure to clients in seven Midwestern states who have a homeowner's policy with us. This includes clients who have purchased earthquake coverage as well as those who have not. The brochure contains information on what people can do ahead of time to protect their property and lives and then also what they should do when an earthquake occurs. We would also include a brochure that discusses the importance of carrying the proper amount of insurance, how building costs can increase after a disaster, etc. The estimated savings to the company and our clients is $5.7 million. Of course, that number can vary greatly depending on how many people actually take action, extent of earthquake damage, etc. We do not anticipate that this mailing would prompt anyone to make structural modifications to their home which would require an engineer or architect.

We might possibly do this in more states and other areas of the country in the future, but we are not committing to that at this time.

Thank you for putting together the trip. It was very well organized and a great experience. It was helpful to hear what the geologists, architects, and others had to say and I certainly learned some new things.

Thanks and best regards.

L.

* * *

Hi Phyllis,

I hope all is going well with you; I really enjoyed the whole trip.

We are Captive Insurance Company writing property coverage throughout the country so I will try and highlight what we have done since the trip.

1. *We are evaluating all our properties in the New Madrid territory and adjusting our premiums based on the quality of the building information we have on file. Probably worth $250,000 to us.*

2. *We are reviewing the specific accounts that we offer EQ coverage and are making sure the pricing is adequate and the exposure is properly underwritten. Probably worth $200,000.*
3. *We are investigating additional markets for EQ coverage and getting premium quotes to enable us to offer higher limits if needed in the future. TBD*
4. *We and our customers are much more aware of the peril of EQ and we have had discussions on what to do in the event of an EQ event. We will do more formalized information dissemination in the future.*
5. *We are going through an effort now to check the adequacy of our current rates to make sure they don't need to be adjusted to stay competitive with the market and the exposure.*
6. *The material made our underwriters much more aware of the exposure and gave them some good background material to discuss with our customers. We have a better understanding of the exposure and its impact on our profitability. "Priceless"*

Thanks,

D.

* * *

Phyllis-

My intent on attending the Earthquake Insight Field Trip was to both increase my knowledge and better understand the types of possibilities and options that are out there. In my role as a risk manager for [our company], I am often called upon to assist in evaluation of properties to be purchased and existing properties.

What I learned will have a direct impact on how I view both of these types of properties and what future or precautionary actions I may need to take. Unfortunately I have not been able to apply anything at this stage but I do think of what I learned often and work that into my thought process.

We have only one operation in the St. Louis area but many in other earthquake zones - such as California and the information will be useful there and throughout the company.

Thank you again for providing a great educational workshop.

J.

* * *

5 Leveraged Benefits – Awareness and Outreach

Planning and leading the *Earthquake Insight Field Trip* allowed numerous opportunities to increase the awareness of earthquake risk in the central US, and, hopefully, to motivate individuals to take action. While documenting all the actual and potential earthquake-risk lowering actions taken was outside the scope of this project, there were definitely indications that progress was made as a result.

There were several dozen major articles or news stories about the field trip that were reported through various print and broadcast media. There were feature articles in the *Washington Missourian* (Appendix N) and in *Business Insurance* (Appendix O). There has been a major feature article in the *St. Louis Post-Dispatch* (whose author was a participant on the field trip) that incorporated several perspectives of the earthquake-risk issue. That author also interviewed several of the field trip presenters and quoted them in the published feature article.

Several participants also indicated in both their written critiques and in personal conversation that they intend to continue and build on the message of earthquake risk through professional and peer groups, in-house networks, and the community at large.

6 Lessons Learned

During the course of planning, developing, and leading the *Earthquake Insight Field Trip*, several do's and don'ts became apparent. They are listed, in no particular order, below.

- Allow <u>at least</u> six months lead time to get the word out to potential field trip participants; eight months lead time would be better. Press releases need to be received by editors well ahead of their deadlines. Some of the target publications are on monthly, bi-monthly, or quarterly schedules and have deadlines several weeks before the actual issue date. Allow plenty of time for the press release to be delivered, printed or issued by the editor, received by the reader, mulled over by the potential field trip participant, and reservations made.
- Build on a window of opportunity, such as the Asian tsunami, which piqued the interest of potential participants and positioned the topic as being especially relevant to real world private-sector and policy issues. (This window of opportunity has opened again, perhaps only for a few months, however, since hurricanes Katrina and Rita.)
- A dedicated website would be helpful and would add legitimacy and credibility to the field trip, as citations by and links to USGS, CUSEC, and other endorsers

could be offered. The URL www.earthquakeinsight.org is available as of early October 2005.

- Do *customize* the press releases offered to chapter newsletter editors, writing from the perspective of *offering something of legitimate value* to their readership. This seemed to be quite effective, reasonably fast, and resulted in the highest hit rate for potential field trip participants.
- Don't focus too much on individual letter invitations. The response rate for this was very low, and the labor and mailing costs involved was relatively high. A few may be appropriate, but they should be very targeted among likely candidate participants who, preferably, are already somewhat familiar with the event.
- The general route, stops, meals, hotels, and motor coach used in the *Earthquake Insight Field Trip*, overall, worked well. The logistics of this event were well suited to the participants and presenters, and the overall logistical template could be re-used quite easily.
- When developing any new route that will be followed by the motor coach, recognize that the travel-time in urban areas is considerably slower in the motor coach than in a personal vehicle. Adjust the estimated travel-times accordingly.
- The accounting demands of a revenue-producing event such as this were a challenge to develop (especially by a non-accountant). However, now that a protocol and mechanism is in place, the next similar event will be much easier.
- Much of the boilerplate of the *Earthquake Insight Field Trip* is easily re-usable – both the physical guidebook materials as well as the know-how of pulling the event together. **Continued maximum benefit will be realized by building on the template for this event and making this a regular and continuing outreach event.**
- Having a one-person staff for this (supplemented by two helpers during the actual event) greatly simplified decision-making, project planning, and communication. However, this also creates a situation that is susceptible to human frailties and other outside events: death, illness, injury, or family emergency affecting that one-person staff could have derailed the entire effort with disastrous results. As it was, this one-person staff was directly affected by a death in the family for this event (and, literally, went from the funeral to the hotel "Welcome Desk"). The "show must go on" – and it did – but not without significant, and perhaps undue, stress. Future field trips should have an alternate leader in case of any emergency.
- Five dry-runs of the route were made before this *Earthquake Insight Field Trip*, the last one being the week before the trip. This was a prudent plan, familiarizing the leader and staff with the route, alternate routes, traffic patterns, and construction zones. Future field trips that use basically the same route probably will need only two or three dry-runs, however.
- This *Earthquake Insight Field Trip* was held during the week after Memorial Day for several reasons. First, there was a higher probability of comfortable weather – before the stifling heat of summer set in. (The actual weather during the field trip was delightful.) Second, being a four-day, holiday work-week, it may have been a convenient week for participants to be out of the office. Third, most state and national legislative bodies had dismissed for the summer, making their members (or their members' staff) more available. Fourth, there were no major

conventions or annual meetings of organizations that included large numbers of potential participants (Risk & Insurance Management Society [RIMS], Casualty Actuarial Society [CAS], or American Banking Association [ABA], etc.). Finally, summer-vacation time was not yet in full swing. Overall the week selected seemed to be quite convenient for the participants and it may be a good one to target for future field trips.

- At the field trip stops (especially ones held outdoors), have large weather-resistant, poster-sized maps, aerial photos, and dry-erase boards available. This will give the presenters a talking point and will help maintain the focus of the participants.
- The across-the-board endorsement of the *Earthquake Insight Field Trip* by the 2005 participants should be used as a way to attract participants to future field trips. This group is a valuable resource that must be courted and enlisted for future outreach efforts.
- A paper was given at the 2005 Annual Meeting of the Geological Society of America (GSA), which described the *Earthquake Insight Field Trip*. While it is good to disseminate the idea of this event to other geoscientists, another (and perhaps better) option may be to present a similar paper before target audiences, such as at the RIMS, CAS, or ABA annual meetings.
- This field trip idea could easily address earthquake hazards and risk along the Wasatch front, the Puget Sound area, Alaska, in several areas of California, Hawaii, the Northeast, or the Wabash Valley. Similar events could also address tsunami hazards and risk along the Pacific or Atlantic coasts.

7 Conclusions & Recommendations

The *Earthquake Insight Field Trip* was an effective outreach tool. The event helped to build personal relationships between active geoscience and engineering researchers and those who need to know, both in the private sector and in public policy-making. It fulfilled its mission.

The leveraged value to society of the *Earthquake Insight Field Trip* was especially cost-effective. The Benefit-Cost Ratio (BCR) of the event was approximately 50,000. This BCR is effectively unprecedented. (For example, the Federal Emergency Management Agency [FEMA] uses a lower-bound BCR of >1.0 to endorse and fund mitigation projects.)

Due to the heightened awareness of unprecedented natural disasters of recent hurricanes, the window of opportunity to address earthquake risk in the central US is open now. There is also significant potential benefit to expand this field trip concept to the Wasatch front, California, Alaska, Hawaii, the Puget Sound area, and the Northeast.

Continued maximum benefit will be realized by building on the template for this event and making this a regular and continuing outreach event.

Appendix A
Partial List of Press Release Recipients

Following is a partial list of public and private organizations, publications, and groups that were sent press releases announcing the 2005 *Earthquake Insight Field Trip*.

For many of these, individual officers of the local chapters of national organizations were contacted by email. For example, for the Risk and Insurance Management Society (RIMS), more than **200** officers of local chapters, from across the country, received the press release. For the Casualty Actuary Society (CAS), several dozen local chapters received the press release.

Alliance of American Insurers (AAI)
American Association of Managing General Agents (AAMGA)
American Bankers Association (ABA)
American Bar Association – Science & Technology Law Section
American Chamber of Commerce Executives (ACCE)
American College of Real Estate Lawyers (ACREL)
American Economic Association (AEA)
American Financial Services Association (AFSA)
American Insurance Association (AIA)
American Management Association (AMA)
American Public Works Association (APWA)
American Real Estate & Urban Economics Association (AREUEA)
American Society for Corporate Secretaries (ASCS)
American Society for Industrial Security (ASIS)
American Statistical Association (ASA)
Appraisal Institute (AI)
Association for Financial Professionals (AFP)
Association of Higher Education Facilities Officers (APPA)
Association for Investment Management and Research (AIMR)
Association of Information Technology Professionals (AITP)
Association of Investment Managers Sales Executives (AIMSE)
Association of Foreign Investors in Real Estate (AFIRE)
Association of Higher Education Facilities Officers (APPA)
[Note: The acronym used does not match current name of the group.]
Building Owners & Managers Association (BOMA)
Casualty Actuary Society (CAS)
Commercial Investment Real Estate Institute (CIREI)
Consumer Bankers Association (CBA)
Disaster Recovery Journal (DRJ)
Distilled Spirits Council (DSC)
Futures Industry Association (FIA)
Global Continuity
Health Insurance Association of America (HIAA)

Insurance Information Institute (III)
Insurance Journal
Insurance Services Office (ISO)
Institute for Business & Home Safety (IBHS)
Institute for Supply Management (ISM)
Institute of Real Estate Management (IREM)
Institutional Real Estate, Inc. (IREI)
International Journal of Critical Infrastructures
International Real Estate Federation - USA
National Association of College and University Business Officers (NACUBO)
National Association of Independent Insurers (NAII)
National Association of Industrial and Office Properties (NAIOP)
National Association of Legislative Information Technology (NALIT)
National Association of Mutual Insurance Companies (NAMIC)
National Association of Purchasing Management (NAPM)
National Association of Real Estate Investment Trusts (NAREIT)
National Automated Clearing House Association (NACHA)
National Conference of State Legislators (NCSL)
National Defense Industrial Association (NDIA)
National School Boards Association (NSBA)
National Venture Capital Association (NVCA)
Newspaper Association of America (NAA)
Pension Real Estate Association (PREA)
Reinsurance Association of America (RAA)
Risk & Insurance Management Society (RIMS)
Urban Land Institute (ULI)
Wall Street Technology Association (WSTA)

Appendix B
Sample Letter Sent to ~300 Key Decision-Makers

Earthquake Insight: St. Louis to Memphis Field Trip

Earthquake Risk in the Central US

May 31 – June 3, 2005

March 4, 2005

W. Allen Reed
President, Chief Executive Officer
GM Asset Management
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PO Box 300
Detroit, MI 48265-3000

Re: Invitation to *Earthquake Insight: St. Louis to Memphis Field Trip*
US Geological Survey Grant 05HQGR0014
http://erp-web.er.usgs.gov/cur_proj.htm

Dear Mr. Reed,

Last December 26, the world learned a difficult lesson. There was devastating loss of life, property, and society due to an "infrequent, high-risk natural hazard" – the Asian tsunami. Is there any way such losses could happen here?

The central US has its own infrequent, high-risk natural hazards: earthquakes from the New Madrid and other fault zones. There are very large, yet infrequent, earthquakes here, and the most recent were in 1811-12. As was seen in Asia, however, "infrequent" does not mean "never."

The US Geological Survey is reaching out to key leaders of our society and economy, like you. This is to enlist the support of those who have both the authority and the responsibility make our region safer from earthquakes. The USGS has authorized a three-day field trip through the heart of central US earthquake country for key leaders in the public and private sector.

Because of your key leadership role, you are invited to participate. This invitation is not open to the general public.

Field trip participants will see field evidence of earthquake hazards and will visit sites of historic earthquake destruction. Participants will talk to geologists, geophysicists, and earthquake engineers. Tough questions will be asked – and the even tougher answers won't be whitewashed.

Enclosed is a FAQ sheet that offers some details about this field trip. Please review this summary and carefully consider participating. If your schedule or workload simply doesn't allow it, however, an appropriate staff member could be sent to act as your eyes and ears.

I hope you agree that both you and General Motors will benefit by the exceptional insight and value of this field trip. Please contact me if you have any questions or ideas about this event.

Very truly yours,

Original Signature and Personal Note on Each Letter

Phyllis J. Steckel, RG
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Appendix C
FAQs: Or, *What Did I Get Myself Into?*

What is this thing? This field trip is funded by the US Geological Survey (USGS) through the National Earthquake Hazards Reduction Program (NEHRP) [pronounced "NEE hurp"]. The overall purpose is to reduce earthquake risk by educating key leaders in public policy and in the private sector (you) and enlisting their help.

Why should I go? Geoscientists have long recognized the very real risk of earthquakes in the central US, and engineers know how to design structures to resist earthquakes. Unfortunately, a lot of new construction in the central US still does not include seismic design. As a result, much of the built environment is at high risk from earthquakes. This field trip is an opportunity for the leadership community to recognize this gap between *what we know about earthquakes* and *what we do about them* – and take action to close it. Lives and property are at stake.

Where are we going? The general route of the trip is from St. Louis, Mo., to Memphis, Tenn. Along the way there will be numerous stops and side trips. The route will crisscross the heart of the New Madrid fault system and will include the highest earthquake-risk areas in the central US.

What will we see? We will see earthquake recorders in university labs, field evidence of large earthquakes that occurred in the past, and landforms created during the great 1811-12 New Madrid earthquakes. We'll also see some engineering solutions that minimize earthquake risk to some critical structures and some large areas that are prone to landslides and other ground failures. The geoscientists and engineers who are doing this work will present their story to the group and will join us for one-on-one discussions. Finally, and maybe most importantly, we'll recognize industrial operations; markets; infrastructure; resources; assets; and logistics, transportation, communication systems that are exposed to high earthquake risk that is *generally unrecognized*. By the end of the trip, participants will recognize and better understand both earthquake risk factors and the tools available to manage them.

How much does it cost? Most of the cost of this field trip is generously subsidized by the US Geological Survey, through a NEHRP grant to Phyllis Steckel. The cost to each participant is $400. This arrangement provides an *exceptional value* to participants.

Who's in charge? Phyllis Steckel, a registered geologist, is the field trip leader. Phyllis received a grant from the USGS for proactive outreach on earthquake risk and how to manage that risk. She has been involved in earthquake risk reduction in the central US for almost 20 years.

What can I expect? Remember, this is a *field* trip, so we'll be *in the field* for part of it – and no whining, please. If it rains, it will be wet. If it doesn't rain, it will be dusty. It may be hot and muggy, or it may be just hot. Or just muggy. It might be clear, warm and pleasant – but don't count on it. At some of the stops we may walk some distance over uneven terrain, so if mobility is an issue, please contact Phyllis (636-239-4013) by May 10.

What about transportation? Transportation is provided round-trip from the departure hotel in St. Louis, via an air-conditioned motor coach equipped with a media system and a restroom. The departure hotel is located near the St. Louis International Airport and offers free airport shuttle service.

Field trippers may ride the motor coach round-trip to/from St. Louis, or they may leave at the end of the field trip from the Memphis International Airport. Those who elect to leave the field trip in Memphis are responsible for their own transportation to the airport from the Central US Earthquake Consortium (CUSEC, our last stop) mid-day on Friday. They also should plan to take a flight that leaves Memphis after 4:00 pm on Friday, June 3.

The motor coach will return to St. Louis, arriving back at the departure hotel probably around 10:00 pm on Friday, June 3, 2005.

There will be at least one escort vehicle that accompanies the motor coach. The escort vehicle is for shuttling speakers and field trip supplies and for use if someone must leave the field trip due to illness or other emergency. The escort vehicle is not available to take participants to any airport.

How about lodging and meals? Three nights lodging are included: Tuesday through Thursday, May 31 through June 2, 2005. Those nights will be spent in St. Louis; Sikeston, Mo.; and Memphis. *If you need lodging in St. Louis on Friday night, June 3, be sure to make these arrangements on your own.*

Ten meals are included: dinner on Tuesday, May 31; and breakfast, lunch, and dinner on Wednesday, Thursday, and Friday, June 1-3. Juice and soft drinks will be available at breaks, and bottled water will be available at all times. If a special diet is required, please contact Phyllis (636-239-4013) by May 10.

Who else is going? The field trip participants include 1) executive leaders of key private-sector companies, 2) leaders of key trade and industry associations, and 3) high-level state and federal policy-makers and their staff. Those in equity, insurance and reinsurance, asset management, commerce, finance, and risk management in the private sector are especially targeted. A roster of field-trip participants and presenters will be included in the field trip guidebook. There is space for 40 field trip participants.

Who will we meet? Along the way, we'll meet with many geoscientists, engineers, and others who are working on the earthquake risk issue in the central US. Some are involved in research, and some are in private practice.

What should I wear? Wear boots or old shoes, and comfortable long pants. Jeans are fine. Geoscientists are among the world's worst dressers, so just about anything you wear will be better than that of your hosts.

What to bring? Definitely bring cameras and extra batteries. Muted cell phones are welcome during the breaks, although coverage may be marginal in some areas. At some of the field sites, there may be insects, poison oak, bright sun, and allergens. Bring a day pack with rain gear, bug repellant, calamine, sunscreen, sunglasses, and allergy meds. Most importantly, don't forget your generous good humor!

What should I expect? Expect camaraderie; new contacts; personal growth; insight; perspective; and knock-your-socks-off relevant, usable information. You may even get ideas to solve a problem you didn't know you had.

Is there anything else? Yes. At the end of the field trip, each participant will be asked to critique the trip. This critique will include an estimation of the risk-reduction actions that he or she plans to implement as a result of the field trip. About 10 weeks after the trip, participants will be asked to estimate the value of the risk-reduction actions that have been implemented. This information will be used to estimate the cost-benefit of the field trip and will be reported to the US Geological Survey.

I still have some questions. How do I get answers? Call or email Phyllis Steckel at 636-239-4013 or psteckel@charter.net.

I'm sold. How do I sign up? Enrollment forms are available via email from Phyllis Steckel (psteckel@charter.net). Just print out those forms, fill them out completely, enclose your check for $400 (payable to *Earthquake Insight*), and mail it all to PO Box 2002; Washington, MO 63090.

Appendix D
USGS Endorsement Letter

US Geological Survey
Central Region – US Earthquake Hazards Program
3876 Central Avenue, Suite 2
Memphis, TN 38152

February 11, 2005

To Whom It May Concern,

This letter is to introduce Phyllis Steckel as a National Earthquake Hazards Reduction Program (NEHRP) grant recipient for 2005. The purpose of the overall NEHRP program is to reduce risk from earthquakes to people, property, and commerce. The NEHRP grant awarded to Ms. Steckel will subsidize a three-day field trip addressing specific earthquake hazards and earthquake risk issues in the central US.

Given the recent losses from the earthquake and tsunami in the Indian Ocean area, this outreach effort may be especially timely.

Field trip participants include key leaders who are being invited to represent three areas: business and industry, media and trade groups, and state and federal elected officials.

To our knowledge, this is the first such outreach effort hosted in the central US that addresses earthquake hazards and earthquake risk. Damaging earthquakes occur infrequently here, but when they do occur, the potential loss to our people, property, and commerce is unacceptably high. Future losses from earthquakes will be minimized by prudent plans and actions within business and commercial operations, government, and industry practice. You are a key part of beginning steps toward this solution.

The US Geological Survey fully endorses the idea offered by Ms. Steckel to develop and lead a three-day field trip for responsible leaders. We know that future large earthquakes will affect the central US. We also know that a prudent solution to this issue may begin with your participation in this event.

Should you have any questions about the US Geological Survey's support of this field trip, please contact either of us directly.

US Geological Survey

Signature

Joan Gomberg, PhD
Research Geophysicist
gomberg@usgs.gov
901-678-4858

US Geological Survey

Signature

Eugene Schweig, PhD
Research Geologist &
Central & Eastern Regional Coordinator
Earthquake Hazards Program
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Appendix E
Sample Press Release Customized for Equity and Finance Audience
(This Email Was Sent to Publications Editor of the American Banking Association)

Holly -- Please consider the following for upcoming ABA *[American Banking Association]* publications, especially those targeting members in the central US. Thanks.

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PRESS RELEASE

Earthquake Field Trip Planned for Finance Industry Leaders

An intensive three-day field trip is being planned to show key leaders in business and policy exactly what they need to know about earthquakes – and the risks they pose – in the central US.

The US Geological Survey recently authorized geologist Phyllis Steckel to develop a field trip for private-sector executives and policy-makers. The field trip will start in St. Louis, Mo. continue to Memphis, Tenn. It is planned for Tuesday evening May 31, through Friday, June 3, 2005.

The field trip is designed for non-scientists who have a leadership background. Participants will meet personally with the scientists who are researching earthquake hazards in the central US.

One purpose is to show participants evidence of past earthquakes and to explain its significance. It will also show how communities, transportation systems, commercial networks, business operations, and communications will be affected by future earthquakes. The field trip will also offer an opportunity for exchange between the research community and real practice.

Finally, participants will gain insight into earthquake-risk management solutions that are currently available, but not often used, in the region.

For example, earthquake-resistant design is often omitted from new construction in the region because of widespread misconception that it adds cost to development. Participants will learn that prudent earthquake-resistant design actually offers a key benefit: a positive change from a "cost item" to "value added." This paradigm shift is a key issue that will be addressed.

The field trip route includes southeast Missouri, western Kentucky and Tennessee, and northeast Arkansas. Participants will see evidence of the 1811-12 New Madrid earthquakes that is still visible. Those earthquakes, estimated to be around magnitude 7-1/2, were felt throughout the eastern two-thirds of the country. They did damage in Georgia, the Carolinas, and Washington, DC. A similar event today would be devastating to the region affected as well as disrupt the national economy and negatively affect worldwide trade.

Cost to each field trip participant is $400, which includes three nights lodging, ten meals, and round-trip transportation from St. Louis via air-conditioned motor coach. Transportation to and from participants' home city is not included. Most of the cost of the field trip is subsidized by the US Geological Survey.

Those who are interested in participating in this field trip should contact Phyllis Steckel, RG at 636-239-4013 or email psteckel@charter.net by April 30, 2005. Space is strictly limited to 40 participants.

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SIDEBAR

Last December 26, the world learned a difficult lesson. There was devastating loss of life, property, and society due to an "infrequent, high-risk natural hazard" – the Asian tsunami. Is there any way such losses could happen here?

The central US has its own infrequent, high-risk natural hazards: earthquakes from the New Madrid and other fault zones. There are large, yet infrequent, earthquakes here, and the most recent were almost 200 years ago. As was seen in Asia, however, "infrequent" does not mean "never."

Foresight to recognize such high-risk issues is rare. And the wisdom to put measures in place that will minimize that risk is even rarer.

Leaders who have authority to make the changes needed to minimize earthquake risk in the central US must recognize the problem and embrace the solutions that are available now. Education is the key.

Appendix F
List of Field Trip Participants

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Appendix G
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Appendix H
Road Log and Guidebook

Earthquake Insight: St. Louis to Memphis

Road Log: *Leave St. Louis Hotel*
East on I-70 to South on I-170 (2 miles)
South on I-170 to East on US 40 & I-64 (6 miles)
East on US 40 & I-64 to North on Grand Avenue (5 miles)
North on Grand Avenue to East (right) onto Laclede Avenue (.25 mile)
Turnaround and passengers disembark in front of Macelwane Hall, Earth & Atmospheric Science Building

Stop 1 – St. Louis University Earthquake Center
St. Louis, Mo.

Saint Louis University has a long tradition in Geoscience education including fundamental contributions to observational and theoretical Geophysics. The department was founded in the 1920s by Dr. James B. Macelwane, S.J., and an exceptional scientist. One notable successor is Dr. Otto Nuttli, who made fundamental contributions to our understanding of central US earthquakes including the great 1811-1812 New Madrid, Missouri earthquakes.

For more information, visit http://www.eas.slu.edu/Earthquake_Center/

ENROUTE –View of downtown St. Louis redevelopment along Washington Avenue and general types of structures having variable degrees of inherent earthquake risk.

ENROUTE – View of earthquake retrofit work in progress on Interstate 64.

ENROUTE – Site of the former Holy Ghost Lutheran Church on the southwest corner of Eighth and Walnut, which was severely damaged and immediately torn down after the 1895 earthquake. That earthquake was located near Charleston, Mo., about 125 miles to the south-southeast. The Stadium West parking garage is on the site now.

ENROUTE – The campus of the Anheuser-Busch Companies World Headquarters has completed significant earthquake retrofit, which has been prioritized and budgeted for its St. Louis facilities over the past decade or so.

Road Log: *From westbound Laclede Avenue, turn North (right) on Grand Avenue (<.5 block)*
North on Grand Avenue to East (right) on Lindell Blvd. (.25 mile)
East on Lindell, which becomes Olive Blvd, to North (left) on Fourth St. (2.5 miles)
North on Fourth St. to West (left) on Washington Ave. (.2 mile)
West on Washington Ave. to South (left) on 14th St. (.7 mile)
South on 14th St. to area under US 40 & I-64 (1 mile)
South on 14th St. to East (left) on Chouteau (.9 mile)
East on Chouteau to North (left) on Tucker (.1 mile)
North on Tucker to East (right) on Market (.6 mile)
East on Market to South (right) on 8th St. (.2 mile)
South on 8th St. through merge with 7th St., then merge with southbound Broadway
South on Broadway to West (right) on Arsenal (2.4 miles)
West on Arsenal, through A-B campus, to I-55 Justin Pearce southbound (.5 mile)
South on I-55 to east (left) on Meramec Bottom Road (Exit 193) (13.8 miles)
East on Meramec Bottom Road to south (right) on Hawkins Road (.2 mile)
South on Hawkins Road to turnaround, just past Heimos Ball Field (.6 mile)

Stop 2 – Meramec River Liquefaction Site
St. Louis County, Mo.

Liquefaction, usually triggered by strong ground shaking during earthquakes, is a physical phenomenon that can cause temporary loss of strength in loose sediments. It may result in ground deformation and damage to overlying ground surface, structures, or infrastructure (utilities, roads, pipelines, levees, or railroads). Liquefaction usually occurs in loose materials, such as sand, that have been deposited by flowing water. Both the central US and the St. Louis region have large areas of these sediments that are vulnerable to liquefaction. Additionally, the region has experienced strong ground shaking as a result of past earthquakes, most notably the 1811-1812 New Madrid earthquake series.

This purpose of a recent study by Lettis & Associates is to identify and assess the deposits in the St. Louis region that are considered vulnerable to liquefaction, and classify the deposits as to their relative susceptibility to liquefaction, such as Very High, Moderate. The final products are a series of five 7.5-minute topographic maps in GIS format that show the liquefaction susceptibility hazard in the St. Louis region due to earthquake-induced strong ground shaking. [See map on next page.]

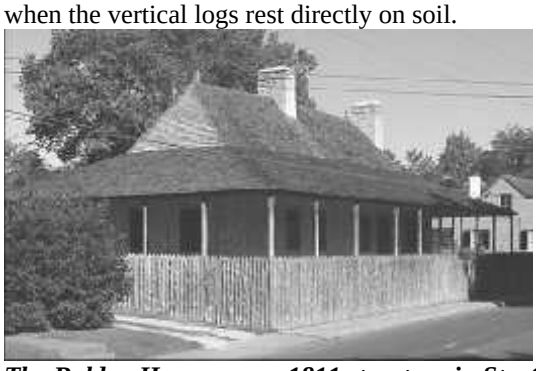
For more information, visit http://erp-web.er.usgs.gov/reports/abstract/2003/cu/03HQGR0029.pdf

Road Log: *Turnaround, then from northbound Hawkins Road, turn West (left) onto Meramec Bottom Road*
West on Meramec Bottom Road to South (left) on I-55 (.2 mile)
South on I-55 to Exit 154, Highway O (39 miles)
East (left) on Highway O to East (right) on Highway 61 (.4 mile)
East (then south) on Highway 61 to East (left) on Market Street (7.4 miles)
East on Market Street to North (left) on Main Street (1.3 miles)
North on Main Street to Hotel Ste. Genevieve; park in lot across from hotel (1 block)

Stop 3 – Structures that Pre-Date the 1811-12 New Madrid Earthquakes
Ste. Genevieve, Mo.

Ste. Genevieve, Mo. was settled in the late 1740s by French-Canadians, who farmed the rich, alluvial soil and produced salt and lead from nearby creeks and mines. The narrow streets and fenced gardens of Ste. Genevieve retain the "French colonial" feel of the settlement. Some of the early buildings were constructed from massive logs, hewn and set vertically to form the walls of the structure. This type of construction is more resistant to earthquake damage than the more widespread practice of building the load-bearing walls of a structure horizontally.

The Bolduc House, shown below, was built about 1785. The structure is built of vertical log walls that are mortised into massive sills that rest on a limestone foundation. This style of construction is known as *poteaux sur sole* ("posts on sill") when built on limestone sills or *poteaux en terre* ("posts on ground") when the vertical logs rest directly on soil.



The Bolduc House, a pre-1811 structure in Ste. Genevieve, Mo.

Road Log: *West on Market St to South (left) on Fourth Street (.3 mile)*
Continue South on Fourth Street, as it bears to the West (right) and becomes Highway 32
West on Highway 32 to South (left) on I-55 (6 miles)
South on I-55 to East/South (left) on Highways 34/61 (Exit 99) (53 miles)
South on Highway 61, which becomes Kingshighway, to East (left) onto Broadway (3.8 miles)
East on Broadway to South (right) on Main St. (2.1 miles)
South on Main Street to left-jog at William St. (.4 mile)
Continue South onto Aquamsi Street (.3 mile)

ENROUTE – Areas of karst topography, which are characterized by natural ponds and sinkholes and uneven surfaces that have little or no surface drainage development. Karst develops over areas of relatively soluble limestone.

Stop 4 – Bill E. Emerson Memorial Bridge – Mississippi River Crossing
Cape Girardeau, Mo.

The Bill E. Emerson Memorial Bridge is a signature, cable-stayed bridge that crosses the Mississippi River at Cape Girardeau, Mo. It is jointly owned by the Illinois Department of Transportation (IDOT) and the Missouri Department of Transportation (MoDOT). Because the bridge is located near the New Madrid fault zone, the owners insisted on engineering the structure to resist earthquake hazards.

There are 84 strong-motion sensors throughout the bridge structure and its foundation. These sensors provide high-quality data that measures and records the real-time structural conditions of the bridge – even during (or after) an earthquake.

This project involved the Federal Highway Administration (FHWA); the Multidisciplinary Center for Earthquake Engineering Research (MCEER); HNTB Corporation, which designed the bridge and managed its construction; the US Geological Survey (USGS); the Illinois Department of Transportation and the Missouri Department of Transportation.

For more information visit, http://mceer.buffalo.edu/publications/bulletin/01/15-04/bridge.asp

Road Log: Continue South on Aquamsi Street, which turns to the West (right) at the stop sign, then bear left onto Maple Street (.2 mile)
West on Maple Street to North (right) onto Sprigg Street (.1 mile)
North on Sprigg Street to West (left) onto Highway 74 (.1 mile)
West on Highway 74 to South (left) onto Interstate 55 (3 miles)
South on Interstate 55 to West (right) onto Highway 77 (Exit 80) (14 miles)
West on Highway 77 to South (left) onto Highway 61 (1.6 miles)
South on Highway 61 to West (left) into General Watkins Conservation Area

(turn at "Morley Baptist Church Welcomes You" sign) (3.9 miles)
Drive into Conservation Area, turn around at top of hill (.2 mile) where there is a large parking lot, and return to small parking area at bottom of hill near Highway 61

ENROUTE – The Little River Drainage District
Southeast Missouri

Draining the Big Swamp
Reprinted on Sunday, October 3, 2004 [originally published on March 4, 1993]
By Sam Blackwell, of the Southeast Missourian

Steam-powered machinery helped workers clear the immense swamp south of Cape Girardeau during the beginning of the 20th century.

"Just after the dawn of the 20th century, a group of businessmen set out to mop up the swamp that was Southeast Missouri. The job, the largest drainage project ever attempted at the time, was completed in a stretch from 1909 to 1926 at a cost of $11 million.

"It turned some half a million acres of soupy cypress forests into some of the state's most fertile agricultural land.

"Often called Dark Cypress, the Big Swamp or the Great Swamp, the area in the flood plain south of Benton in Southeast Missouri was all but uninhabited by humans until early in the 20th century. All kinds of wildlife, including bears, abounded.

"'It has a mystique of its own,' says Frank Nickell, director of the Center for Regional History at Southeast Missouri State University. '... It was sort of a forbidden area. There were very few trails in it.'

"The marshlands, then constituting one of the largest swamps in the American interior, would have resembled the Mingo National Wildlife Refuge, which, ironically, is an artificial swamp resurrected from cornfields.

"Transforming the Big Swamp was Herculean work that required mosquito-repellent men, steam-powered stump pullers and dredges, and about 20 years.

"Though it took many more years to clear the land for farming, and the Depression nearly forced bankruptcy, the Little River Drainage District eventually was a boon to Southeast Missouri. Cotton, and later corn, soybeans, watermelon, potatoes and other crops became the mainstays of the economy. Ancillary businesses also blossomed.

"The plan was not universally loved, however. Cape Girardeau railroad builder Louis Houck was chief among the opponents, challenging the plan all the way to the U.S. Supreme Court.
He called it a 'scheme promoted by a bunch of real estate speculators' and predicted 'it will be a gigantic failure.'

"The project was opposed by the railroads the Cottonbelt, Frisco and St. Louis Iron Mountain and Southern because they had built lines into the swamp to serve the timber industry and the few farms that existed.

"The district also created two distinct classes of people in the region -- those who owned the newly drained land and those who merely worked on it, says Nickell.

"'The people in charge of draining the swamps were the people who bought up the land, and they did not share with the people on the bottom,' he said.

"The Bootheel counties today have the state's worst poverty.

"Until the district was formed in 1907, isolated attempts dating back to the early part of the 19th century had been made to drain parts of the land, but the swamp usually reclaimed its own. A grand plan was needed, one that would encompass parts of seven counties and move more earth than the builders of the Panama Canal.

"The crucial element of the project was the Headwater Diversion Channel, which stretches about 40 miles from near Greenbriar in Stoddard County to its outlet into the Mississippi River south of Cape Girardeau. Castor River, Crooked Creek, Hubble Creek and the Whitewater River enter the channel at various points and continue to the Mississippi.

"'That was the key to making the other parts work,' said Larry Dowdy, executive vice president of the district. 'It diverted the source of the water supply that made that swamp.'

"The southern part of the project primarily consists of five parallel ditches that carry runoff to the Arkansas state line, where it becomes part of the St. Francis River and eventually the Mississippi.

"'What makes this part of the project work is the 100-foot drop in elevation from Cape Girardeau to the Arkansas border,' Dowdy says.

"Ditch No. 1 is the longest, running more than 100 miles. The ditches, including the many laterals carrying water to the primary ditches, range in width from 20 to 220 feet, and have an average depth of eight feet.

"The lower portion of the district has 850 miles of ditches and 240 miles of levees. Also essential to the project are three water detention basins that store flood water, preventing the levee on the south side of the Diversion Channel from being topped when the rivers are running high.

"Today, the district's 27 full-time employees, with the assistance of the U.S. Corps of Engineers, maintain more than 900 miles of levees and channels. The maintenance cost is about $1 million a year. Two million acres of water a year move through the district's channels and ditches. The Diversion Channel itself carries 750,000 acres of water annually.

"The 2,300 landowners within the district contribute maintenance taxes at an average rate of $2.50 an acre.

"Ninety percent of the land was covered in timber before the draining of the swamp began. Today 95 percent of the land is cleared."

Stop 5 – General Watkins Conservation Area
Near Sikeston, Mo.

The Commerce fault is located along the south edge of the Benton Hills (which are sometimes called the English Hills) and the east edge of Crowley's Ridge in Stoddard and Scott counties in southeast Missouri. This area is also characterized by numerous landslides, which may obscure or complicate the interpretation of faulting. As one travels south on Interstate 55, this south flank of the Benton (or English) Hills is the last bedrock at the surface: unconsolidated sediments cover the earth's surface from this area south to the Gulf of Mexico.

For more information, visit http://erp-web.er.usgs.gov/reports/abstract/2003/cu/03hqgr0095.pdf

ENROUTE – Sand boils are visible from north of Sikeston and on to the south for 100 miles or more. The Sikeston Ridge, a pressure ridge probably associated with faulting at death, is an uplifted area

that reduced the risk from flooding to early settlers. The Sikeston Ridge is up to about 25 feet higher than surrounding surface, and is trends from north of Sikeston to New Madrid. [See map on next page.]

ENROUTE – Sikeston infrastructure straddles a sand fissure – which is similar to a sand boil except that the saturated sand erupts to the surface along a line rather than at a point.

Road Log: *South on Highway 61 to South (right) on Highway Y (11.9 miles)*
South on Highway Y to West (right) on Highway Y (.3 mile) [highway makes a 90-degree turn to west]
West on Highway Y to South (left) on Highway BB (2.8 miles)
VANTAGE ENROUTE – Large sand boil, southeast quadrant of this intersection
South on Highway BB to East (left) on Wakefield Road (.5 mile)
Stop motor coach: participants may exit motor coach if they wish, although view is probably better from the vehicle
East on Wakefield Road to South (right) onto North West street 1.8 miles)
South on North West Street to East (left) on Malone (1 mile)
East on Malone to Drury Inn (2602 East Malone; Sikeston MO; 573-471-4100) (4 miles)

OVERNIGHT IN SIKESTON

Road Log: *South on Interstate 55 South to South on US 61/62 (exit 49) (17 miles)*
South on US 61/62 to East (left) onto Highway U (3 miles)
VANTAGE ENROUTE – At Highway U, note large sand boils in fields to west; nursing home to southwest
East on Highway U [highway makes several turns] to South (right) onto Main Street (1 mile)
VANTAGE ENROUTE – 510 Main Street, note external steel frame of telephone infrastructure
South on Main Street to Mississippi River Observation Deck & New Madrid Museum (1 mile)

Stop 7 – New Madrid Museum and Mississippi River Overlook
New Madrid, Mo.

New Madrid was the largest European American settlement between New Orleans and St. Louis in 1811. It was poised as a key community, having a strong prospect for future growth – until December 16, 1811. The following excerpt is from a letter from a New Madrid resident to his friend in Lexington, Ky., dated 16th December, 1811, and including additional notes written over the next few days.

"About 2 o'clock this morning we were awakened by a most tremendous noise, while the house danced about and seemed as if it would fall on our heads. I soon conjectured the cause of our troubles, and cried out it was an Earthquake, and for the family to leave the house; which we found very difficult to do, owing to its rolling and jostling about. The shock was soon over, and no injury was sustained, except the loss of the chimney, and the exposure of my family to the cold of the night. At the time of this shock, the heavens were very clear and serene, not a breath of air stirring; but in five minutes it became very dark, and a vapour which seemed to impregnate the atmosphere, had a disagreeable smell, and produced a difficulty of respiration. I knew not how to account for this at the time, but when I saw, in the morning, the situation of my neighbours' houses, all of them more or less injured, I attributed it to the dust and sot (?), &c which arose from the fall. The darkness continued till day-break; during this time we had EIGHT more shocks, none of them so violent as the first.

"At half past 6 o'clock in the morning it cleared up, and believing the danger over I left home, to see what injury my neighbours had sustained. A few minutes after my departure there was another shock, extremely violent - I hurried home as fast as I could, but the agitation of the earth was so great that it was with much difficulty I kept my balance - the motion of the earth was about twelve inches to and fro. I cannot give you an accurate description of this moment; the earth seemed convulsed - the houses shook very much

- chimnies falling in every direction. - The loud hoarse roaring which attended the earthquake, together with the cries, screams, and yells of the people, seems still ringing in my ears.

"Fifteen minutes after seven o'clock, we had another shock. This one was the most severe one we have yet had - the darkness returned, and the noise was remarkably loud. The first motions of the earth were similar to the preceding shocks, but before they ceased we rebounded up and down, and it was with difficulty we kept our seats. At this instant I expected a dreadful catastrophe - the uproar among the people strengthened the colouring of the picture - the screams and yells were heard at a great distance.

"One gentleman, from whose learning I expected a more consistent account says that the convulsions are produced by this world and the moon coming in contact, and the frequent repetition of the shock is owing to their rebounding. The appearance of the moon yesterday evening has knocked his system as low as the quake has leveled my chimnies. Another person with a very serious face, told me, that when he was ousted from his bed, he was verily afraid, and thought the Day of Judgment had arrived, until he reflected that the Day of Judgment would not come in the night.

"Tuesday 17th - I never before thought the passion of fear so strong as I find it here among the people. It is really diverting, or would be so, to a disinterested observer, to see the rueful faces of the different persons that present themselves at my tent - some so agitated that they cannot speak - others cannot hold their tongues - some cannot sit still, but must be in constant motion, while others cannot walk. Several men, I am informed, on the night of the first shock deserted their families, and have not been heard of since. Encampments are formed of those that remain in the open fields, of 50 and 100 persons in each.

"Tuesday, Dec. 24th - The shocks still continue - we have had eight since Saturday - some of them very severe, but not sufficiently so to do much additional injury. I have heard of no lives being lost - several persons are wounded. This day I have heard from the Little Prairie, a settlement on the bank of the river Mississippi, about 30 miles below this place. There the scene has been dreadful indeed - the face of the country has been entirely changed. Large lakes have been raised, and become dry land; and many fields have been converted into pools of water. Capt. George Roddell, a worthy and respectable old gentleman, and who has been the father of that neighborhood, made good his retreat to this place, with about 100 souls. He informs me that no material injury was sustained from the first shocks - when the 10th shock occurred, he was standing in his own yard, situated on the bank of the Bayou of the Big Lake; the bank gave way, and sunk down about 30 yards from the water's edge, as far as he could see up and down the stream. It upset his mill, and one end of his dwelling house sunk down considerably; the surface on the opposite side of the Bayou, which before was swamp, became dry land, the side he was on became lower. His family at this time were running away from the house towards the woods; a large crack in the ground prevented their retreat into the open field. They had just assembled together when the eleventh shock came on, after which there was not perhaps a square acre of ground unbroken in the neighborhood, and in about fifteen minutes after the shock, the water rose round them waist deep. The old gentleman in leading his family, endeavoring to find higher land, would sometimes be precipitated headlong into one of those cracks in the earth, which were concealed from the eye by the muddy water through which they were wading. As they proceeded, the earth continued to burst open, and mud, water, sand and stone coal, were thrown up the distance of 30 yards - frequently trees of a large size were split open, fifteen or twenty feet up. After wading eight miles, he came to dry land. . . .”

Aerial Photo of New Madrid, Missouri
Splotchy and mottled areas show sand boil and san fissures, some of which are from the 1811-12 New Madrid earthquakes.

Road Log:

North on Main Street to West (left) onto Virginia Street (.3 mile)
West on Virginia Street to North (right) onto Powell Street (1 block)
North on Powell Street to West (left) onto Scott Street (1 block)
West on Scott Street to South (left) onto Highway 61 (1 mile)
South on Highway 61(which turns to the southwest) to North (hard right) onto Bloomfield Road (.6 mile)
North on Bloomfield Road to sand boils (250 feet)
VANTAGE ENROUTE: Sand boils
Continue on Bloomfield Road, which makes several jogs, to East (right) on road just past cemetery (2 miles)
VANTAGE ENROUTE: "Sand Hill Cemetery"
Continue on unnamed road (still Bloomfield Road?) to North (left) onto Highway 61 (1 mile)
North on Highway 61 to North on Interstate 55 (4 miles)
North on Interstate 55 to North on Interstate 57 (17 miles)
North on Interstate 57 to East on US Highway 62 (exit 12) (toward Cairo, Illinois)

(11 miles)

VANTAGE ENROUTE: Epicentral Area of 1895 Earthquake that caused collapse of Holy Ghost Lutheran Church at 8th & Walnut streets in downtown St. Louis

East on US Highway 62 to South (right) on US Highway 51 (toward Wickliffe, Bardwell, and Clinton) (11 miles)

South on US Highway 51 to West on Highway 123 in Clinton (25 miles) [note: this is the "second" intersection w/Hwy 123]

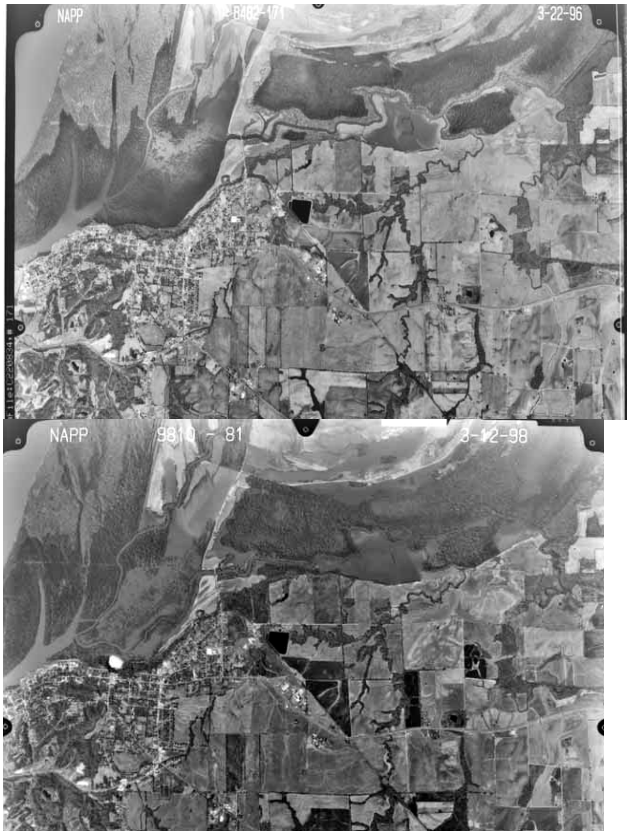
West on Highway 123 (several 90-degree jogs) to South (left) on Highway 239 (toward Moscow and Cayce) (3 miles)

VANTAGE ENROUTE: Loess Hills, some karst

South on Highway 239 to West on Highway 94 (which becomes Moscow Street in Hickman) (9 miles)

West on Highway 94 (Moscow Street in Hickman) to North (right) onto Troy Street (just past water tanks) (9 miles)

Turn into Health Department parking lot to view landslide scarp and repair



Active Mississippi River Bluff
Hickman, Kentucky

These two aerial photos were taken in 1996 (left) and 1998 (right). The white spot in the left center of the 1998 photo shows the landslide repair just below the town's water supply, police station, and health center.

The Hickman Bluff has a history of instability dating back to the New Madrid earthquakes of 1811-1812. The instability has resulted in crest of the bluff retreating 3 to 5 feet per year. This caused an approximately 400 ft. deep by 600 ft. deep wide semi-circular recess in the bluff and resulted in the

complete loss of Magnolia Street in 1990. Deep-seated movement along an existing slide plane present in the underlying Jackson Formation Clay has also been an ongoing problem.

In 1998, the US Army Corps of Engineers contracted for bluff stabilization. That stabilization work included over 100,000 square-feet of permanent, soil-nailed wall to stabilize the upper and lower bluff slopes. About sixty 70-foot-long horizontal drains lower the ground water table behind the face of the landslide. Soil anchors that are over 200 feet long increase the factor of safety for overall stability with respect to the existing slide plane in the Jackson Formation Clay. A 40-foot bluff extension, using a reinforced soil slope with light-weight fill, allowed the reconstruction of Magnolia Street.

Road Log: *Circle Health Department Building and exit parking lot to West (right) onto Moscow Street*
West on Moscow Street to North (right) onto Wabash Street (.2 mile)

VANTAGE ENROUTE: Landslide-prone slopes, broken and tilted structures, sidewalks, utility poles, etc.
North on Wabash Street to Highway 94 (.3 mile)
West on Highway 94 to Tennessee line, where Highway 78 South begins (12 miles to state line)
South on Highway 78 to West (right) on Phillippy Road (2.5 miles from state line to Phillippy)
West on Phillippy Road to South (left) on Cates Landing Road (2 miles)
South, then southwest, on Cates Landing Road to South (left) on Van Works Road (3 miles)
VANTAGE ENROUTE: 1811-12 scarp

Reelfoot fault scarp near Tiptonville, Tenn.

A trench excavated across the Reelfoot scarp in the late 1970s showed faults, folds, and liquefaction features. Interpretation of these features suggests that there have been at least three episodes of major faulting in the area (Russ, 1979).

Road Log: *South on Van Works Road (which turns to the east) to South (right) on Highway 78 (1 mile)*
South on Highway 78 to East (left) on Highway 21 (6 miles)
East on Highway 21 to south side of Reelfoot Lake and North (left) into lakeside parking lot near picnic pavilion (~6 miles)
East on Highway 21 to South (right) on Bluff Road (at Lassiter's Corner) (3.5 miles)
South on Bluff Road to East (left) on unnamed blacktop road on north side of Paw Paw Creek (3.6 miles)
East on blacktop road to North (left) on abandoned farmstead access road, about .1 mile before bridge over Paw Paw Creek (1.6 miles); park on farmstead road
Walk to exposure along Paw Paw Creek (350 feet)

Paw Paw Creek Cut Bank Exposure, Western Kentucky
Photo of a group of field trippers led by Roy Van Arsdale

Road Log: *From Paw Paw Creek, backtrack West on unnamed road to South (left) on Bluff Road (1.6 miles)*
South on Bluff Road to West (right) on Gratio Levee Road (4.3 miles)
West on Gratio Levee Road to South (left) on Highway 78 (3.0 miles)
South on Highway 78 to West (right) on Highway 79 (2.0 miles)
West on Highway 79 to South on Highway 181 (3.7 miles) [main road makes wide turn to south here; number changes from Highway 79 to Highway 181]
South on Highway 181 to West on Interstate 155 (9.7 miles)
West on Interstate 155 to West on Highway U (8.6 miles) (Exit 4)
West on Highway U to South (left) on Interstate 55 (3.6 miles)
South on Interstate 55 to ***Rest Stop*** *(last one in Missouri) (11.9 miles)*
South on Interstate 55 to East (left) onto Highway 150 (3.4 miles) (in Arkansas, Exit 71)
East on Highway 150, through "Number Nine," then South (right) on Highway 137 (9.7 miles) [road makes several jogs]
South on Highway 137 to Hickman, Arkansas, then West (right) on Highway 137 (2.4 miles)
West on Highway 137 to West on Highway 18 (Highway 137 makes several jogs) (6.0 miles)

Mississippi County, Arkansas
Industrial Development

Mississippi County, Arkansas, is home of the Riverport steel mill complex, which is the second largest steel-producing county in the nation. Local industries include Nucor Steel, Nucor-Yamato Steel, Paco Steel, Maverick Tube (2 plants), Coil Tec, Terra International, Milwaukee Tool, Siegel Roberts, NIBCO, American Greetings, Creative Foods LLC, and others.

The local fire department is staffed by volunteers and is not tax-supported: funding for equipment comes from donations, grants, and fund-raisers. There are 3000 residents in the local area, and 5000 employees of the steel-related industries.

West on Highway 18 to South on Interstate 55 (5 miles)
South on Interstate 55 to East on US 40 (61.1 miles)
East on US 40 to North on Sycamore View Drive (Exit 12) (25 miles)
North on Sycamore View Drive to Drury Inn entrance on right (.1 mile)

OVERNIGHT IN MEMPHIS

North on Sycamore View (right out of parking lot) to West (left) on Summer Ave (.3 mile)
West on Summer Avenue to South (left) on Perkins (3 miles)
South on Perkins to West (right) on Walnut Grove Road (1.2 miles)
West on Walnut Grove to South (left) on Goodlett (1 mile)
South on Goodlett to West (right) on Central (.6 mile)
West on Central to North (right) into CERI parking lot

Center for Earthquake Research & Information
University of Memphis

For more information, visit http://www.ceri.memphis.edu/index.shtml

West (right) out of parking lot on Central to North (right) on East Parkway (3 miles)
North on East Parkway [US 70] to West (left) onto North Parkway (1.8 miles)
West on North Parkway to North (right) on North Third Street (3.7 miles)
North on North Third Street to West (immediate left) onto Auction Avenue (1 block)
West on Auction Avenue to North (right) on Mud Island Drive (.4 mile)
North on Mud Island Drive to West (left) into Public Access parking lot (1.6 miles)
Turn around in parking lot, then South (right) on Mud Island Drive to "road closed" sign at US 40 Seismic Retrofit Project Staging Area (2 miles)
Turn around at staging area, then north on Mud Island Drive to East (right) on Auction Avenue (.4 mile)
East on Auction Avenue to South (right) on Second Avenue
Eventually, follow signs to Southbound Interstate 55 [road closed by barricades during field trip dry-runs]
South on Interstate 55 to East (left) on Shelby Drive (10 miles)

Distribution Industry
Memphis, Tenn.

"Memphis leads the nation's top 100 cities with the highest percentage of its workforce involved in the logistics industry. Memphis has 32,000 people employed in the warehouse and transportation sector, which ranks sixth nationally in total size. When an additional 37,500 workers in the Memphis wholesale trade sector are added to the mix, the percentage of the overall Memphis labor force raises to 17 percent and the number of logistics workers totals more than 100,000.

- #1 busiest cargo airport in the world. More than 3.3 million tons were shipped in 2002, the 10th consecutive year Memphis has held the number one position.
- #3 in Class 1 railroad service in the U.S., approximately 220 freight trains cross through Memphis every day.
- #3 trucking corridor in the U.S. More than 300 truck lines operate out of Memphis.
- #4 U.S. inland port. The Port of Memphis handled 16,401,000 tons in 2002.

"Memphis has built on its familiar image as 'America's Distribution Center'. It has a wholesale distribution industry worth $10,000,000,000 and its international airport is the world's busiest air cargo port. Eleven companies have their headquarters here, including *Gibson Greetings*, known as *Cleo*, which produces a staggering two billion feet of gift-wrap every year. Memphis also has one of the busiest cement terminals in America, shipping over 400,000 tons of cement each year.

"The city's traditional industries still play an important role in its commercial life. Memphis is home to the world's largest processors of hardwoods and it is still the world's largest 'spot' cotton market, where cotton is traded 'on the spot', as it was in the 19th century. *Federal Express*, the world's largest overnight package delivery company, was launched here in 1973 and now employs 30,000 people."

Road Log: *East on Shelby Drive to North (left) on Getwell Road (3.7 miles)*
North on Getwell Road to East (right) on Raines Road (1 mile)
East on Raines Road to South (right) on Lamar (1 mile)
South on Lamar to West (right) on Shelby Drive (1.3 miles)
West on Shelby Drive to South (left) on Getwell (2.1 miles)
South on Getwell to West (right) on Holmes Road (1 mile)
West on Holmes Road to North (right) into CUSEC driveway (1.7 miles)

Central US Earthquake Consortium (CUSEC)
Memphis, Tenn.

The Central U.S. Earthquake Consortium is a partnership of the federal government and the eight states most affected by earthquakes in the central United States. Those states are Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee.

For more information, visit http://www.cusec.org/

Appendix I
List of Regional Emergency Healthcare Facilities
Earthquake Insight Field Trip

as of May 2005

Arranged in approximate order of field trip route

Barnes-Jewish Hospital
One Barnes-Jewish Hospital Plaza
St. Louis, MO 63110
314-747-3000

St. Alexius Hospital
3933 S. Broadway
St. Louis, MO 63118
314-865-7000

Jefferson Memorial Hospital
1400 US Highway 61
Festus, MO 63028
636-933-1000

Ste. Genevieve County Memorial Hospital
U.S. Highways 61 & 32
Ste. Genevieve, MO 63670
573-883-2751

Perry County Memorial Hospital
434 North West Street
Perryville, MO 63775
573-547-2536

Southeast Missouri Hospital
1701 Lacey Street (near Broadway)
Cape Girardeau, MO 63701
573-334-4822

Missouri Delta Medical Center
1008 North Main Street
Sikeston, MO 63801
573-471-1600

Community Health & Emergency Services, Inc.
13245 Kessler Road
Cairo, IL 62914
618-734-4400

Clinton-Hickman Co. Intermediate Care Facility
366 South Washington Street
Clinton, KY 42031
270-653-2461

Parkway Regional Hospital
2000 Holiday Lane
Fulton, KY 42041
270-472-2522

Lake County Primary Care
217 South Court Street
Tiptonville, TN 38079
901-253-6690

Baptist Memorial Hospital
Russell & Bishop Streets
Union City, TN 38261
731-885-2410

Pemiscot Memorial Hospital
Highway 61 & Reed
Hayti, MO 63851
573-359-1372

Twin Rivers Regional Medical Center
1301 First Street
Kennett, MO 63857
573-888-4522

Baptist Memorial Hospital
1520 North Division Street
Blytheville, AR 72315
870-838-7300

Baptist Memorial Hospital
Lee & Grandview Streets
Osceola, AR 72370
870-563-7000

Appendix J
Media Press Releases Sent Immediately Before Field Trip

For more information, please call these individuals on their cell phone:
Phyllis Steckel 636-359-1955 (please do not contact until after 3:00 pm on Tuesday, May 31 due to death in family)
Jim Wilkinson 901-409-2621
Buddy Schweig 901-268-8685
Gary Patterson 901-229-4764

PRESS RELEASE
For June 1, 2005
Earthquake Insight Field Trip to Visit Local Area

The Earthquake Insight Field Trip will be in the area on Wednesday, June 1. Field trip participants are high-level executive leaders in the insurance, finance, and business sectors and public policy-makers who are learning first-hand about earthquake risk in the central US. The group includes a total of about 45 people.

Participants are from all over the US, including New York, Georgia, California, Vermont, Minnesota, Rhode Island, Texas, and Connecticut, as well as Missouri, Illinois, and Kentucky. Many national and international insurance and reinsurance companies are represented, as are several national manufacturing, energy, and communications companies. Three state senators will also participate.

This field trip is part of a grant from the US Geological Survey to Phyllis Steckel, a registered geologist. Steckel (of Washington, Mo.) and about 20 other regional geoscientists and engineers are leading the group on a three-day trek from St. Louis to Memphis. The route will crisscross the heart of the New Madrid fault system and will include a look at the highest earthquake-risk areas in the central US.

****
Editor's NOTE:
While in the local area, the field trippers will visit:

- the St. Louis University Earthquake Center in Macelwane Hall, between about 8:30 to 9:30 am;
- the Meramec River Liquefaction Site, at the south end of Hawkins Road, just east of I-55, off Meramec Bottom Road, between about 10:15 and 10:45 am;
- Downtown Ste. Genevieve, around the Ste. Genevieve Hotel, between about 11:45 am and 1:15 pm;
- Emerson Memorial Bridge, Cape Girardeau (the stop is on Aquamsi Street, directly under the bridge) between about 2:45 pm and 3:15 pm;
- General Watkins Conservation Area (just off Highway 61, north of Sikeston, near Morley) between about 4:00 pm and 4:30 pm.

Many of the field trip leaders, from universities, research centers, the US Geological Survey, and other state and federal agencies, will be available for brief interviews during the stops. There will be photo opportunities.

❒ Structural engineers know what types of structures that have performed well in past earthquakes, and those that have performed poorly. Story idea: explore the relative risk of high- and low-risk structures types in Missouri.

❒ When a large earthquake occurs in California, emergency response is led by California state government and FEMA Region IX. Because the New Madrid fault system straddles several states, emergency response here will include seven to 15 states and four FEMA regions. Story idea: explore the complexity of preparing for an event that will involve so many agencies.

❒ Areas that adopt building codes that include earthquake design requirements *and* help their property owners *comply* with those codes **significantly** reduce earthquake risk. Story idea: delve into how effectively (or ineffectively) local communities *comply* with current codes.

❒ Unfortunately, Missouri's building codes are among the weakest in the nation. In 93 of 114 Missouri counties, including most of the area at highest risk from the New Madrid fault, *building codes are prohibited by state law*. Story idea: explore the political pressures that allow this situation.

❒ If a building code is "on the books," it does *not* necessarily mean that buildings are earthquake resistant. Depending on the jurisdiction, the owner of a structure may have to specifically request that the building's architects and engineers include earthquake-resistant design. Story idea: present information on how a building owner may have to "take the lead" in incorporating earthquake-resistant design into their facility.

Phyllis J. Steckel, RG
PO Box 2002
Washington, MO 63090
636-239-4013

Appendix K
Critique Summary

A critique given to 27 participants, 2 presenters, and 1 support staffer resulted in the following results. All ratings were on a one-to-five scale, where *five* is the highest or most favorable ("Yes!") and *one* is the lowest or least favorable ("No!").

PROGRAM	Meet expectations?	4.47
	Most information new?	4.02
	Gain insight?	4.30
	Guidebook helpful?	4.57
PRESENTERS	Informative?	4.70
	Prepared?	4.67
	Understandable?	4.52
	Questions handled OK?	4.70
	Comfortable to contact presenters later?	4.73
LOGISTICS	Motor coach?	4.87
	Hotel?	4.70
	Meals & snacks?	4.63
	Start & end times OK?	4.57
	Registration smooth?	4.87
VALUE	Worth your time?	4.80
	Worth $400.?	4.93
	Recommend to others?	4.77
	Add value to your operations?	4.50
	Value added >$400.?	4.74
ACTION	Take action?	4.43
	"Talk it up" to others?	4.63
	Invite presenter to professional meeting?	4.23

Appendix L
Critique Comments

- Speakers/Handouts/Areas covered were all excellent. Logistics were well run. Interaction was above average. Trip was a little long, but what to eliminate is a tough decision. Lots of info. I rate it 5 stars for me.

- I plan to write a series of articles on the earthquake hazard, risk, and preparedness….On a personal note, I cannot tell you how much I enjoyed this experience! You and the "blue crew" did an amazing job in pulling this together, particularly given your own family responsibilities [a death in family three days before trip]. I admire your organizational skills and your energy…this trip put it all into perspective…Please don't hesitate to call on me for assistance in the future….

- Phyllis did an outstanding job in organizing the trip and along with the Earthquake Insight crew made this highly worthwhile. Time is always an issue and perhaps 2 days would have been better – although difficult to cover all the ground you did. One presenter did a shameless plugging of his projects, but was very informative nonetheless. Severe enthusiasm from all was exciting to be a part of!

- Would have like to have seen more on first day – Maramack [sic] River rather than maps. Overall, extremely impressed with the quality and professionalism of presenters. Am positive that the contacts made will be expanded upon with the goal of spreading the message to an even wider audience.

- Excellent. Good coordination. Good hotels. Good food. Peggy [sic] gave a lot to put it all together.

- Was very well done. Would have liked some more actual field time (trenches, etc.)

- Phyllis – A few suggestions to consider: 1) many of the speakers had PowerPoint presentations and/or maps. Including them in the handouts would be beneficial. 2) I liked the stops and materials presented at the Meramec River an other sites, but somehow I had the impression that we were going to see the actual [undecipherable] on the riverbank or the trenches. The stops made it real, I just thought it was going to be more real. 3) I can't express enough how much I enjoyed the experience. The knowledgeable presenters, the great locations chosen, and what can I say – those sand blows! A good mix of commercial and government infrastructure, all well planned and coordinated.

- Seems to have needed computer support at some times. Some equipment lacking? Needed more opportunity to drink water/have on bus.

- Insurance guy: unfortunately our investment of reserve assets is highly regulated by the states. I would love to steer investment more toward catastrophe-smart companies. Potential return: we don't write much stand-alone central US EQ business because the market price is too low → this involves the companies not run as well as those your participants are from. Recommend inviting individuals from state insurance departments and insurance rating agencies (AM Best, S & P [Standard & Poor's]).

- Use more poster-sized display materials at stops that illustrate what's being discussed. 2) Include route map in guide book.

- Very well done. Keep the quality up – and may the force be with you…

- A good field trip. Enjoyed and found value in risk reduction techniques, retrofit, etc. Someone in loss control of an insurance carrier that writes a lot of EQ would have been informative.

- Trip was intensive! Excellent planning, pre-trip information was excellent.

- The speakers were great and communicated so we could understand. Everyone loves the hands-on and field trip. Phyllis did a great job in a difficult logistics effort. I will use this information for education purposes with my customers.

- Would like to have had more field work on the first day. The best part was being able to see things up close. Speakers/Presenters were excellent. I can the see the passion of the geologists, engineers, etc. The trip was very well organized.

- Overall, very good program. Second day on the bus was a little long in terms of travel time. More field work would be good as well. Having the experts & geologists along was the best part of the trip.

- More background on stops in booklet. More views/tours of vulnerable and protected buildings. Interaction with EQ researchers was great. Make available presenter slides to take back to company.

- Very well done. I learned so much and having actual professionals/leaders in their perspective fields was awesome.

- We need to show them more stuff in the field and walk more. [from a presenter]

- Produce a video tape eventually that could be shared by a wider, less accessible audience.

- Very pleasantly surprised to find the geologists & people involved in earthquake hazard reduction effort very knowledgeable and very nice! Thank you so much.

Appendix M
Critique Value

VALUE of EIFT Stated on Critique Sheets

Participant Number	Value Stated	Comments
1	$22,571	
2	$40,000	
3		"very high value"
4	$20,000,000	
5		"NA"
6		no response
7	$400,000	
8	$1,500	
9		no response
10	$1,000,000	
11		no response
12	$2,000,000,000	"priceless: billions"
13		"seven out of ten"
14	$2,500	
15	$1,000	
16		no response
17	$1,000	
18		no response
19		no response
20	$10,000	
21		no response
22		"a great deal"
23		no response
24		no response
25	$2,000	
26		"NA"
27		"a 10 on the Richter scale"
28	$2,000	
29	$100,000	
30	$100,000,000	
TOTAL	**$2,121,582,571**	

Appendix N
Feature Article in the *Washington Missourian*

On the Road to 'Earthquake Insight'

By Karen Cernich
06/24/2005

Phyllis Steckel of Washington was perusing her stock portfolio one day last year when she began to notice something slightly alarming -- not with the companies' performances, but their locations.

Many of them have facilities along the New Madrid Seismic Zone, which stretches from Memphis, Tenn., to southern Illinois.

As a registered geologist, Steckel knows well that the question of a major earthquake occurring in this area isn't "if," but "when." And the potential for damage and loss of life is great -- the history of quakes that in this zone prove that.

In 1811 and 1812 the New Madrid zone produced three of the largest earthquakes to occur in the continental United States.

"That's when I made the connection," she said.

"An earthquake in the central (United States) can have the same ripple effect on our economy happened after 9-11."

As she thought more on the subject, Steckel knew of no one in the geoscience field who was focused on this area and she didn't see any evidence that businesses were concerned either. So she decided to organize her own outreach program specifically targeting the public and private business sector.

"It had never been done before, to reach out to people who are in a position to make real changes in earthquake risk," she remarked.

Steckel, who works under contract as a consulting geologist, applied for a research grant from the U.S. Geological Survey as part of the 2005 National Earthquake Hazards Reduction Program (NEHRP). She was one of only five individuals to receive funding. Most of the grants were awarded to universities, state governments or consulting companies.

Steckel used her funding to organize a three-day field trip -- the first of its kind -- from St. Louis to Memphis, Tenn., that stopped at key points along the way to see firsthand evidence of past earthquake damage and understand the potential for catastrophic damage in the region when the next major quake occurs.

In a letter to the field trip participants, members of the U.S. Geological Survey spoke to the importance of

such a project.

"The purpose of the overall NEHRP program is to reduce risk from earthquakes to people, property and commerce," wrote Joan Gomberg, Ph.D., research geophysicist, and Eugene Schweig, Ph.D., research geologist and central and eastern regional coordinator of the earthquake hazards program.

"Damaging earthquakes occur infrequently here. But when they do occur, the potential loss to our people, property and commerce is unacceptably high.

"Future losses from earthquakes will be minimized by prudent plans and actions within business and commercial operations, government and industry practice."

The Audience

Steckel's audience on the tour was a group of about 30 prominent business leaders from all corners of the country.

The Walt Disney Company/ABC Inc. out of New York City sent a director of risk and environmental management.

Chubb Insurance Group out of New Jersey sent a vice president of catastrophe modeling.

GE Insurance Solutions out of Chicago sent a lead property actuary, and another office sent a senior underwriter.

Pfizer Inc. out of New York City sent an insurance manager/loss control specialist.

Two state senators from St. Louis County also attended.

A large portion of the companies that were represented were from the insurance industry, but they weren't the only group Steckel tried to recruit.

She went after the insurance, finance and business industries, professional organizations and national associations, among others -- high-level policymakers, leaders of key industry groups and private-sector executive managers.

"My effort was to get people in business, to target where the money is," said Steckel.

"I wanted the people who own the shopping centers, the pipelines, the people who are making capital investments."

The message she drove home to them wasn't just about raising their awareness of the risk, but to plan for it.

"We can minimize our risk by how we build our structures, where we build our power plants, what kind of dependence we as a community have on just-in-time deliveries," she said.

Steckel made the distinction between earthquake hazard -- "what we all live with," the potential for a quake to occur, and earthquake risk -- "what is introduced by what we do as a community."

What They Saw, Heard

The point of the field trip was to show these key individuals in the public and private sector how to recognize and address earthquake risk factors, such as site selection, operations exposures and vulnerable market shares, said Steckel. She titled the project "Earthquake Insight: Field Trip From St. Louis to

Memphis."

The tour included information on the good that has already been done in the region to minimize risk, as well as the bad -- the risk that is being ignored.

Along the way Steckel had arranged for numerous presenters (scientists, engineers, managers and others) to provide detailed information.

Helping drive home the message of the project, a 3.9 magnitude earthquake occurred in the New Madrid zone during the trip, said Steckel.

The first stop on the tour was the St. Louis University Earthquake Center. From there the group viewed the redevelopment along Washington Avenue in St. Louis to see general types of structures with variable degrees of earthquake risk, the earthquake retrofit work that's in progress on Interstate 64 (Highway 40) and the campus of Anheuser-Busch Companies World Headquarters, which over the last decade has completed a significant earthquake retrofit.

Other stops and sights on the tour included:

* Meramec River liquefaction site in St. Louis County.

* Ste. Genevieve structures that pre-date the 1811-1812 quakes along the New Madrid zone.

* Bill E. Emerson Memorial Bridge at the Mississippi River crossing in Cape Girardeau.

* Little River Drainage District in Southeast Missouri.

* General Watkins Conservation Area in Sikeston.

* Sand boils that resulted from previous earthquakes.

* New Madrid Museum and Mississippi River Overlook.

"New Madrid was the largest European American settlement between New Orleans and St. Louis in 1811," Steckel noted. "It was poised as a key community, having a strong prospect for future growth -- until Dec. 16, 1811," when the first of a series of major earthquakes hit the region.

Another major earthquake hit the New Madrid seismic zone in 1895 near Charleston, Mo. The shock was felt as far north as Canada and is credited with causing the collapse of the Holy Ghost Lutheran Church at Eighth and Walnut streets in St. Louis.

Steckel's field trip participants saw the epicenter of that 1895 quake. More sites and stops included:

* Landslide-prone slopes, broken and tilted structures, sidewalks, utility poles, etc.

* Reelfoot fault scarp near Tiptonville, Tenn.

* Industrial development in Mississippi County, Ark. -- home to the Riverport steel mill complex.

"Northeast Arkansas is the second largest steel-producing area in the country," said Steckel. "There are plants built right on the New Madrid fault system. And when that business is interrupted, we're all going to feel it."

* Center for Earthquake Research and Information at the University of Memphis.

* Distribution industry in Memphis.

"Memphis is a hub of distribution for many companies because of its connection to Federal Express," Steckel said, noting FedEx is the world's largest overnight package delivery company.

She pointed out several other facts about the city's standing in the distribution industry.

Memphis has the No. 1 busiest cargo airport in the world. More than 3.3 million tons were shipped in 2002.

Memphis is No. 3 in Class 1 railroad service in the country -- approximately 220 freight trains cross through Memphis daily.

Memphis is the No. 3 trucking corridor in the country. More than 300 truck lines operate out of Memphis.

And the city is No. 4 among U.S. inland ports. The Port of Memphis handled nearly 16.5 million tons in 2002.

* The group ended the tour with a visit to the Central U.S. Earthquake Consortium (CUSEC) in Memphis, Tenn.

What Now?

When the trip concluded Steckel asked the participants to take the information they had heard and seen back to their companies and offices and start asking questions.

"Go back and do something with this," she said. "Factor it into your operations."

Her other request of them was that if changes are made to lower risk, to send her an estimate on the value of those changes in terms of savings.

ABC/Disney is planning to upgrade their towers and broadcast units in the New Madrid zone, Steckel said as an example. If they incorporate seismic design as a result of this field trip, and that potentially saves damage from a major earthquake, "What value is that to ABC?"

Steckel heard many positive comments from the participants at the end of the trip, which has led her to consider hosting it a second time.

"There's a need for it," she remarked.

Appendix O
Feature Article in Business Insurance (trade magazine)

Tour highlights possibilities of earthquake damage

Published Date: September 19, 2005
http://www.businessinsurance.com/cgi-bin/industryFocus.pl?articleId=17484&issueDate=2005-09-11

It has been nearly 200 years since residents along the New Madrid fault have experienced devastating earthquake damage. While small temblors have occurred in the central Mississippi Valley over the intervening years, none has come close to matching the intensity of three magnitude-8 earthquakes that struck the area in the winter of 1811/12.

But the U.S. Geological Survey, along with the congressionally established multi-agency National Earthquake Hazards Reduction Program, in an effort to be prepared for a catastrophic earthquake, recently funded a field trip to explore the New Madrid seismic zone and determine what potential hazards could develop if another powerful earthquake were to occur.

The trip took place from May 31 to June 2, with 29 participants that included insurance underwriters and claims executives, risk managers and state senators. Participants came from across the United States to evaluate the potential risks of the New Madrid seismic zone. The zone was named for New Madrid, Mo., a town located close to the epicenter of the 1811/12 quakes that rang church bells in Boston 1,000 miles away, and resulted in reports of damage as far away as Charleston, S.C., and Washington D.C.

Geologist Phyllis Steckel was able to lead the trip thanks to a grant received from the USGS to provide outreach on earthquake risks and their management. Participants paid $400 for transportation, lodging and food, but most of the trip's costs were subsidized.

The field trip was geared toward decision makers and policy makers who are in positions to make changes to lower the risk of hazards from earthquakes in the area.

"The participants did not just include those from the insurance industry," Ms. Steckel noted. "The strong majority were in the insurance industry and were risk managers or corporate insurance directors, but the trip was originally open to those in equity and portfolio management, mortgage holders, banks and corporate property managers."

The goal of the trip was to gain a better understanding of earthquakes and the damage that could result from a major event.

"One of our objectives was to establish contact with the principal bodies engaged in the various aspects of research into the region and to gain an insight into how the regulatory bodies are addressing issues such as retrofitting and the readiness of emergency planning," said Ken Slack, a field trip participant and a senior underwriter of global property catastrophe at GE Insurance Solutions in Barrington, Ill.

The participants, along with 25 to 30 geoscientists and engineers, viewed the infrastructure along the fault to get an idea of what has occurred in the past and what can be done to prevent damage in the future.

Eugene "Buddy" Schweig, a USGS geologist in Memphis, Tenn., set the scene on the trip with introductory talks on the New Madrid area and its history.

"The 1811 (earthquake) was not a one-time event. Research shows prehistoric events occurred in 900 A.D. and 1450 A.D. that were similar to the 1811 earthquake," Mr. Schweig said. "Given what we know, the

likelihood of a repeat event in the next 50 years is about 10%. It's about 20% for an event of 6.0 magnitude or higher."

In order to educate participants about potential risks, the group made several stops to view signs of earthquake damage.

"We looked at several aspects, several sites that are geological evidence of the earthquake," Ms. Steckel said. "We looked at fault scarps, areas that weren't lakes in 1811 and now are."

The group also examined buildings that had not been designed to resist earthquake shaking. They were told that buildings should either be designed to resist earthquake shaking or be retrofitted. Retrofitting involves re-engineering and restructuring existing buildings to strengthen their walls and frames without compromising their architectural elements.

Ms. Steckel also reviewed the economic risks associated with proximity to the seismic zone. The group looked at industries concentrated in certain economic areas that have very high risk for damage. For example, Ms. Steckel explained that the far northwest corner of Arkansas is home to the second-largest steel production county in the United States. If a large earthquake were to occur, it would cause significant disruption and result in a ripple effect throughout the economy.

In addition, the logistics and distribution industry in Memphis provides warehousing for the inventory for several large companies such as Williams-Sonoma Inc., The Walt Disney Co., computer software providers and industrial and auto parts companies. These warehouses were not designed to resist earthquakes, and, because retrieval systems are robotic, a disaster could cause a vast disruption.

Mr. Schweig noted that the trip was organized at an opportune time; he explained that the New Madrid area had seen four minor earthquakes between February and June of this year.

"Everyone came because they knew there were earthquakes here. It probably helped all of the participants to be able to go back to their workplace and better explain the issues involved," he said. "I heard over and over, `It sure was different seeing it rather than reading about it in a book.'"

Bill Dalton, property claims director in St. Louis for Novato, Calif.-based Fireman's Fund Insurance Co., said that he gained more insight into the massive destruction that these earthquakes could cause.

"Being able to view some of the geological changes in soil, rock and creeks that indicated the damage 200 years ago gave me a better idea of what had occurred," Mr. Dalton said. "Seeing the instruments from the early 1900s and seeing the sophisticated equipment we have now was amazing. Scientific progress has come a long way, but earthquakes are still hard to predict and we still have a lot to learn."

Ms. Steckel explained that the USGS has seismographs in the field located in the countryside between Memphis and St. Louis that provide a lot of information on where earthquakes occur and why they occur in these areas. She stressed, though, that figuring out what drives earthquakes and predicting when the next one will occur remain difficult tasks.

"There are a lot of ethical considerations on this as well," Ms. Steckel said. "If you're wrong about a prediction, you can be liable for the losses of life or property. You have to take precautions to minimize risk, and this can be done cost effectively."

Mr. Dalton said that earthquake preparation can be as simple as making sure that shelves are fastened, removing heavy objects from shelves, bracing overhead light fixtures and having disaster supplies on hand. The most important element, according to Ms. Steckel, is to have structures properly built to resist earthquakes in the first place.

Mr. Slack said the trip was very beneficial, adding that he would like to see another excursion with the USGS.

"Greater understanding will only come through continued research," he said. "It is vital that, as an industry, we work as closely as possible with the scientific community. Any change in the perceived level of risk will emanate from the study and research of the scientific community."